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THE CLIMATE OF THE BRITISH EMPIRE IN 1895.

OUR annual climatological table for 1895 presents one unusual feature. The highest shade temp. was recorded at an East Indian station, the 107°·2 at Calcutta being apparently the highest reading there in the past 15 years, while Adelaide, which usually heads the list, recorded a maximum well below the normal.

The other extremes set out in the summary, fall so regularly to certain stations that they call for little comment. For extreme cold and range of temperature, Winnipeg is unapproachable, while year after year Ceylon shows the smallest total range, the highest mean temp. and the greatest rainfall. Malta, again, one is quite prepared to see with the smallest rainfall. The greatest and least amounts of cloud, perhaps, fall less regularly to any given station than the other elements; but Esquimalt and Bombay have frequently appeared for the two extremes. Jamaica, on the other hand, appears for the first time. Adelaide, usually prominent in the summary of extremes, this year retains its place only as the driest station.

Summary.

Highest Temp. in Shade ...	107°·2 at Calcutta, on May 20th.
Lowest ,, ,, ...	—45°·5 at Winnipeg, on Feb. 5th.
Greatest Range in Year ...	133°·8 at Winnipeg.
Least ,, ,, ...	26°·9 at Colombo, Ceylon.
Greatest Mean Daily Range	23°·0 at Winnipeg.
Least ,, ,, ,, ...	10°·3 at Mauritius.
Highest Mean Temp.	81°·7 at Colombo, Ceylon.
Lowest ,, ,, ...	34°·5 at Winnipeg.
Driest Station	Adelaide, mean humidity 59.
Dampest Station	Esquimalt, ,, ,, 89.
Highest Temp. in Sun	178°·0 at Trinidad.
Lowest Temp. on Grass ...	—27°·0 at Toronto.*
Greatest Rainfall	92·23 in. at Colombo, Ceylon.
Least ,, ...	11·38 in. at Malta.
Most Cloudy Station.....	Esquimalt, average amount 6·6.
Least ,, Stations	Bombay and Jamaica, aver. amount 3·9.

* The min. on grass is not recorded at Winnipeg.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1895.

Stations. *Those in Italics are South of the Equator.*	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Mean.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Average. Cloud.
	°		°		°	°	°	°		°	°	in.		0—10
England, London ...	86·2	May 30	7·3	February 8	57·9	41·8	49·9	41·8	78	135·3	5·0	21·47	137	5·8
Malta	103·6	July 5	34·2	February 19	73·5	59·6	66·5	56·9	75	159·0	31·7	11·38	67	4·5
Mauritius	89·5	February 18	54·8	June 22	79·6	69·3	74·5	65·3	76	137·3	45·6	54·16	196	5·7
Calcutta	107·2	May 20	47·4	December 25	86·7	70·3	78·5	68·6	74	160·5	38·0	39·38	74	4·1
Bombay	93·8	June 7	60·8	January 23	85·8	74·9	80·4	71·5	75	144·5	49·8	67·59	109	3·9
Ceylon, Colombo ...	93·7	May 1	66·8	January 31	87·7	75·6	81·7	71·7	77	157·0	55·0	92·23	201	5·4
Melbourne	100·6	February 13	29·5	June 17	68·2	49·6	58·9	47·7	69	155·9	20·4	17·06	131	5·2
Adelaide.....	105·4	Feb. 12, 13	36·9	May 26	73·0	53·5	63·3	48·1	59	174·0	29·6	21·27	130	4·7
Sydney	96·1	December 15	36·8	July 9	69·8	56·3	63·1	54·1	73	157·2	24·6	31·89	173	4·6
Wellington.....	88·0	February 20	32·0	July 13, 26	61·2	49·1	55·1	46·3	72	145·0	20·0	61·49	176	4·8
Auckland	85·0	February 18	37·0	July 21 / August 3	64·6	52·5	58·5	49·7	73	145·0	32·0	44·15	203	5·3
Jamaica, Kingston..	94·6	August 17	62·8	December 21	87·5	71·1	79·3	68·9	76	...	...	20·89	78	3·9
Trinidad.....	95·0	May 11	63·0	Feb. 5, 25	87·9	69·6	78·7	70·4	76	178·0	62·0	62·23	178	..
Toronto	93·4	May 30	—21·2	February 6	52·9	35·6	44·2	36·9	75	109·5	—27·0	28·04	161	5·7
Manitoba Winnipeg	88·3	August 15	—45·5	February 5	46·0	23·0	34·5	..	...	...	...	18·42	148	5·9
British Columbia, Esquimalt	82·0	May 16	20·1	November 5	55·4	41·6	48·5	44·1	89	...	...	32·40	188	6·6

THE SCIENTIFIC USE OF KITES.

IN February, 1895, we gave in these pages some particulars respecting Mr. Rotch's efforts to obtain records of temperature, &c., at great heights by means of kites, and quoted some of the results which had been obtained at the Blue Hill Observatory in July and August, 1894.

In the *Met. Mag.* for August, 1896, Mr. Rotch pointed out that the credit of priority in this field of work belonged to a Scotchman, Dr. Wilson, who had used tandem kites in 1749.

The following paragraph shows how extremely successful Mr. Rotch's staff at Blue Hill have been :—

> The observers at the Blue Hill Observatory, near Boston, Mass., report that a 3lb. meteorograph, made by Richard, of Paris, was raised by them by means of 2⅛ miles of piano wire, on July 20th, to a height of 5,961 ft. above the hill, thus breaking all kite-altitude-records Three Eddy kites, made by Fergusson, passed through and beyond the clouds, and were only visible at intervals between breaks in the clouds. The kites and instruments remained at the highest point half-an-hour, and exerted a pull of from 110 to 120lb. The meteorograph showed that the air was very dry above the clouds, and about 18° colder than at the earth's surface.

But this was far surpassed on October 8th, of which the following is the account in the *New York Advertiser*:

> William A. Eddy, of Bayonne, N. J., has received from the observers at the Blue Hill Observatory, near Boston, the definite particulars of the extremely successful kite flying test which they made on October 8th.
>
> The ascension was to an altitude never before reached. The operators sent their meteorograph to the height of 9,385 ft. More than three miles of piano wire was paid out, the ascension beginning at 9.5 in the morning and ending at 9.15 in the evening. When the highest point was reached, the pull on the wire was from fifty to ninety-five pounds.
>
> The instrument entered and passed through the clouds as shown by the record of a very dry air above the clouds. The temperature fell from 46 degrees on the hill to 20 degrees at an altitude of 8,750 ft. The meteorograph record, in ink, on a revolving cylinder run by clockwork, was the best and clearest yet obtained. The recording apparatus was more than a mile high during three hours.

The Americans are now giving great attention to the subject, and Prof. Willis Moore, the Chief of the Weather Bureau, has detailed Prof. Marvin and other members of his staff for study of this branch of meteorological research. With the ample resources of the U.S. Weather Bureau, remarkable developments may reasonably be expected, and we certainly wish the Bureau every success. The

Monthly Weather Review (which, under Prof. Cleveland Abbe's able editorship is becoming a sort of American Meteorological Magazine) has recently contained a series of articles by Prof. Marvin on the History, and Theory of the Meteorological use of Kites, with reference especially to their form and construction. We understand that besides the experiments at Washington, the Weather Bureau is having others made in California, Montana, and Michigan.

It may merely betray our own ignorance, but there is one point on which we have seen no statement. A kite can go up only when there is wind, a balloon can go up in a calm; a kite cannot carry as much weight as a balloon. Why are kites better than captive balloons?

The last (July) number of the *Monthly Weather Review* gives the following interesting report from the far North-West—just E. of the Rocky Mountains:—

KITES IN MONTANA.

By Mr. A. B. Coe.

From the recent letters received from Mr. R. M. Crawford, director of the Montana section of the Climate and Crop Service, and from Mr. A. B. Coe, voluntary observer at Kipp, Montana (N. 48° 45′, W. 112° 45′, elevation about 4,000 ft.), we take the following notes, and hope that others may be led to pursue similar studies with the same enthusiasm. Mr. Coe says:

I herewith transmit an account of a little experiment tried recently, employing a cellular kite of the dimensions described in the November, 1895, *Weather Review* for the purpose, and my maximum thermometer.

A phase of our climate at this station is the frequent veering of the wind from westerly points to north or north-east, accompanied by an extremely rapid fall of temperature, and usually more or less precipitation.

I have often thought that these cold waves did not reach very high up, and that at no great height above them the warm south-west wind still prevailed. For several days prior to July 19th, 1896, my maximum had been climbing up into the nineties too frequently for comfort. The air was dense with smoke, when the wind suddenly veered to the north-east, blowing steadily at about 15 or 20 miles an hour, and pretty thoroughly clearing the atmosphere of smoke. The temperature fell 51° in the next twenty-four hours, and on the 21st the clouds were dragging on the ground, and precipitating both rain and snow. At 11.30 a.m., on that date, my minimum thermometer registered 32°, but only for about twenty minutes, when it rose to 38°. From occasional glimpses of the sun obtained through breaks in the clouds, and from its red appearance, it was evident that there was another current of air full of smoke at a low altitude, blowing from the west, and undisturbed by the cold wave from the north-east beneath it.

The time and circumstances seemed propitious to test my theory, so I climbed to the top of a hill near my home, which I found by triangulation to be about 200 ft. above my usual place of observation. Thither I bore my tailless kite, maximum thermometer, and 4,800 ft. of No. 24 twine, tagged at every 100 ft. for convenience in computing elevation. I secured the thermometer firmly in a pasteboard tube, open at both ends, and fastened this to my kite with wire. At 1.15 p.m. the surface temperature was 38°, when with the help of an assistant I soon had both kite and instrument mounting steadily upward on a flight of exploration.

I will have to add right here that my kite is a "stayer," and the only one of any description I ever made that would fly. I let it run out 1,000 ft., and on drawing it in found there was no difference in its registration. Again I let it out, and it was not until 3,900 ft. of twine had unreeled that any change in its action was observed; then I noticed that the kite above the fog and clouds was pulling nearly north-east, instead of south west, as at first. Upon pulling it in, during which operation it again assumed its strain to the south-west, I was overjoyed to discover that the register stood at 77°, while at the point where I stood it remained at 39°. Being anxious to make sure that there was no mistake, I sent the instrument up again, and obtained a like result at about the same altitude, the kite going through the same movements as at first; but whether my observation is of any value aside from the personal satisfaction derived, is a question.

I anticipate some interesting experiments this coming winter in this direction, to determine, if possible, at what elevation the warm winds locally termed "chinooks" blow, at times when their influence is felt many miles east of this point, while remaining intensely cold here.

In response to a request for further data as to the protection of his thermometer and other matters. Mr. Coe writes:

I employed a strong pasteboard tube 12 in. in length, and $1\frac{3}{4}$ in. in diameter for the purpose. In this I sewed my maximum thermometer securely with strong pack thread, and packed fine cotton around each end for the better protection of the tube. Directly over the tube I cut a slit $\frac{1}{4}$ by 8 in., so that the scale could be readily seen without removing the instrument. Four feet from the belly-band I secured the tube to the twine with fine wire. The wind was blowing a good stiff breeze at the time, probably 20 miles an hour, and from the time the kite was let go until pulled in 23 and 25 minutes, respectively, elapsed, and the difference in temperature at each trial was the same as stated. My kite rose and descended very steadily without diving or pitching, so that I could not well believe that the difference in temperature was caused by any condition other than an upper current of warm air, blowing from the south-west at that altitude. The clouds near the earth were very dense, while from another experiment tried at the same time, I am satisfied that the kite passed through the clouds into bright sunshine. I secured a strip of sensitized paper between two thin pieces of mica, and sent it up attached to the kite, and exposed a similar piece to the light on the ground, in a like manner to protect the paper from dampness. While the paper at my feet remained unchanged in colour to any extent the piece sent up was changed to a bronze black.

ESCHUID-ASHINDON.

To the Editor of the Meteorological Magazine.

SIR,—In reply to Dr. Hellmann, the following is extracted from "Memorials of Merton College," (Oxford Historical Society) by the Hon. G. C. Brodrick, Warden (p. 200).

"John Ashindon or Ashinden, also called Eastwood (1338), according to Anthony Wood was the greatest mathematician and astronomer ever produced by Merton College, as well as an eminent physician. In these researches he was aided by his brother Fellow, William Rede, and published treatises in concert with him, besides several under his own name. His works are cited with great respect by Pico de Mirandola. Anthony Wood dates from him a succession of mathematical and astronomical students at Merton, extending over at least a hundred and fifty years after his time. But he (Anthony Wood) adds that nearly all their works disappeared from the College library—probably together with many hundred volumes of school divinity—during the visitation in the early part of Edward VI.'s reign, when such books relating to natural science, being regarded as profane, if not diabolical, were burned, or sold as waste paper. Not less than a cartload of valuable MSS. are said to have been thus abstracted from Merton College Library. This statement Anthony Wood makes on the authority of Thomas Allen, 'the famous mathematician of Gloucester Hall,' in the reign of Queen Elizabeth, whose evidence was reported to Wood himself by John Wilton, Chaplain of Merton."

Yours truly,

C. E. PEEK.

Rousdon Observatory, Devon.

To the Editor of the Meteorological Magazine.

SIR,—In reply to Dr. Hellmann's letter, *re* Eschuid, in the *Met. Mag.* of September, may I refer him to *Notes and Queries* of November 23rd and December 7th, 1895, pp. 409, 452; January 18th, February 22nd and March 14th, 1896, pp. 52, 152, 218; July 25th, 1896, p. 83?

Yours truly,

FRED. COVENTRY.

Duddington, Stamford, Sept. 24th, 1896.

ISOBARS.

To the Editor of the Meteorological Magazine.

SIR,—I have found an earlier use of the word Isobar: *H. K. W. Berghaus* in 1838. In the text accomanying his Physical Atlas (p. 63) he calls isobars (Isobaren) the lines of mean equal atmospheric pressure at the level of the sea.

The isobarometric lines which Mr. J. Lardner Green mentions in

the magazine, p. 138, are not lines of equal pressure, but lines of mean equal oscillation of the barometer first drawn by L. F. Kämtz, in 1832 (*Lehrbuch der Meteorologie* Band II., s 339, and pl. III.). Kämtz remarks in a foot-note that *the* name adopted by him is not quite right, as isobarometric lines indicate properly lines of equal pressure, but he excuses himself with a sentence from A. Kircher, "in verbis simus faciles." Just for this reason Berghaus adopted the new word isobars for lines of mean equal pressure, which at that time were still supposed to run parallel to the equator, although G. A. Erman had previously (in 1831) pointed out that the mean atmospheric pressure varies not only with the latitude but also with the longitude (Poggendorff's Annal. XXIII., 144).

G. HELLMANN.

Berlin, October 18th, 1896.

METEOROLOGICAL OBSERVATIONS IN SCHOOLS.

Prepared for the Connecticut State Board of Education by ROBERT DE C. WARD, Instructor in Meteorology in Harvard University.

THE time has come when meteorology should be systematically taught in our schools. It is a subject of the greatest practical interest and importance. It lends itself very readily to teaching. It trains those who study it, in habits of scientific thought and investigation, Already in many of our grammar and high schools some meteorological instruction is given, and the keeping of meteorological records by scholars is every year becoming more general. As yet, however, there is no *system* in all this work, and, in consequence, much that is being done is wasted effort, without definite result. The present circular is designed to indicate some of the lines along which the elementary study of meteorology should proceed in order to be most thorough and most useful.

The children themselves, even in the earliest primary school years, take the first step towards an understanding of our ordinary weather changes. They unconsciously notice whether a day is fair or rainy, hot or cold, a pleasant one on which to be out, or one on which they would rather stay indoors. These facts are temporarily impressed upon their minds when they start for school; when recess time comes; and when they go home. If it is raining or snowing, they need umbrellas and rubbers [goloshes]; if it is cold, they need overcoats; if it is windy, they find it hard to walk; if it is icy, they can enjoy themselves sliding on the ice; if there is soft snow on the ground they can make snowballs; if it is very hot, they prefer to walk in the shade. We are all so directly affected by the weather conditions prevailing at any moment, that even the youngest school children are forced (unconsciously, to be sure) to take some notice of these conditions. Here lies the first work of the teacher who wishes to teach her scholars something rational as to the simpler facts of meteorology.

The first step is to make the children intelligent observers of

weather changes and conditions, instead of leaving them merely blind, unconscious subjects, as they otherwise are. This introductory work on the part of the teacher is simple, and, if entered upon with enthusiasm, becomes very helpful to both teacher and scholars. It may be briefly sketched as follows: When the children come to school on some snowy winter day, with a violent north-east wind, chilling and damp, attention may be called to the need of overshoes and overcoats; to the fact that the snow should be shaken off the clothing in order to prevent the latter from becoming wet; to the piling up of the snow in deep drifts at certain places near the school or in the town, while in other places the ground is left bare; to the ease with which snowballs may be made, and to other facts which will very readily suggest themselves. A day or two after such a storm, when the sun is shining brightly in a cloudless sky; when there is no wind and the air is dry, cold, and crisp, the contrasts between these two weather types should be brought out. Instead of snow we now have sunshine; instead of a damp, chilling north-easter we now have a calm, and the air is dry; snowballs cannot easily be made in the early morning, because the snow is frozen hard and is too dry, but towards noon, if the temperature rises high enough, there may be thawing on the tops or sides of the snow-drifts, and there the snow becomes soft enough for snow-balling. Another weather type, often noted during our New England winter and strongly contrasted with both of the preceding conditions, is that which brings us a warm, damp, southerly wind, frequently accompanied by heavy rains. As these damp winds blow over snow-covered surfaces they become foggy and the ground is said to "smoke;" the heavy rain rapidly melts the snow; slush and mud make bad walking; rivers and brooks rise rapidly, perhaps overflowing their banks; low-lying places become filled with standing water. These and other features should all be brought out by the teacher, not by telling the children of them directly, but by judicious questioning, and they should be contrasted with the conditions which may immediately follow, when the storm has cleared off, and when the low temperatures brought by a "cold wave," with its dry north-west wind, have resulted in freezing lakes, rivers, and brooks; when skating and sliding may be indulged in, and when hot fires are a necessity.

Early summer weather conditions, with their accompanying warm spells, thunder storms, and sea breezes, furnish another long list of typical changes that should be just as carefully noticed and described as the more striking winter characteristics—in fact, these examples might be extended indefinitely. Enough has, however, been said to indicate the lines along which this preliminary training of the children should proceed. The central idea should be to train the scholars in intelligent weather observation, so that they may come to appreciate what our typical weather changes are; that they may recognize the types as they recur over and over again, and may see

how each example differs from, or accords with, those that have preceded it. In this way, by spending only a few minutes a day on the subject, the teacher may soon bring her children to the point of being intelligent, rational observers, and by the end of the primary school years they should have in mind, not only our typical weather changes, but the larger facts of seasonal change as well.

This simple method of getting an appreciation of our seasonal and daily weather types is a very important step towards a rational understanding of the larger facts of meteorology. It should, in all cases, precede the next step—observations with instruments.

In the instrumental work, which may usually be begun in the early years of the grammar school course, it is not well to attempt anything more than records of temperature, wind direction and velocity, and rain and snowfall. Current observations without the use of instruments should, however, be made in addition, such observations including the state of the sky (clear, fair, cloudy); the kind of precipitation (rain or snow), &c., together with any other notes as to peculiar features which may happen to be noticed day by day.

Temperatures are of course registered by thermometers. For school use a good mercurial thermometer, costing $2 or $3 (say 10s.), should, if possible, be purchased.*

Ordinary thermometers, costing 50 cents or $1 [2s. to 4s], are inaccurate, and records from them are of little value. The thermometer ought to be hung away from any building, in the shade, about four feet above a grass-covered surface, but as this is in most cases impossible or impracticable, it does sufficiently well for general purposes if the instrument is fastened outside a north window, at least 1 ft. away from it, and so arranged that it can be read from inside without opening the window. If possible, a window should be selected which is seldom opened.

Wind directions may be taken from the indications of a neighbouring vane, but care should be taken to see that the vane is in good working order. Wind velocities may be roughly estimated as, calm; light; moderate; strong; gale.

Rain may be measured by means of an ordinary lard pail, or even a tomato can with the top cut off evenly and sharply. This should be set in an open space, away from trees and buildings, and ought to be so arranged that it can be fastened to a short stake to prevent its blowing over. The depth of water in the can may be measured, roughly, with a foot rule, divided into inches, quarters, and eighths. In the case of snowfall, which is difficult to measure satisfactorily, the best way is to select some flat space where the snow has not drifted and then to press the inverted can down on the snow, thus cutting out a circular section of snow. By means of a thin board,

* A mounted mercurial thermometer, of the Weather Bureau pattern, can be purchased from Julien P. Friez, 107, East German Street, Baltimore, Md., for $3 [12s.]

or a shovel pushed under the can, the snow inside the can is retained, and the can with its contents may be taken indoors. There the snow should be melted and the depth of water it produces measured.

These are, of course, very simple and very crude observations, but they are all that can be attempted in most schools, and are certainly all that can well be attempted at the start in any case. If the older scholars are especially interested, the instruments may easily be added to. Maximum and minimum, and wet and dry bulb thermometers; a standard rain-gauge, a barometer, &c., may be secured, and much fuller records kept, but these additional instruments are somewhat expensive, and their care and observation require much time.

Now, when should these simple records be made, and how should they be preserved? The answer to these questions ought to be left to the scholars themselves to work out. They will probably begin by thinking one observation a day quite sufficient, and they will perhaps prefer to take this in the morning, before school opens. It is a good plan to have a different scholar assigned to the duty of taking the observations every day, the better scholars being given this piece of work as a sort of reward, and it is also advisable to have the daily weather record written upon the blackboard so that all can see it. The teacher should lead the scholars to see that only one observation of the temperature a day does not serve to give a fair average for that day. The temperature usually rises towards noon, and a reading of the thermometer made at 8.30 or 9 a.m. is often much too low for the actual temperatures experienced in the early afternoon. In this way, by judicious questioning and suggestions, the children will soon come to see the need of several observations of the temperature, the wind direction and velocity, the state of the sky, &c., and in time it may be so arranged that an observation can be taken every hour during school days. One reading of the rain gauge a day will, however, usually be sufficient.

At the end of each day the blackboard data should be entered in a permanent record book by some one of the scholars, and some ingenuity can be exercised in devising the best scheme for keeping this record. The record book should be carefully preserved in the schoolroom, where it may be referred to by the scholars of future years when any unusually severe storm, or a spell of excessively hot or dry weather, or a remarkable "cold wave" occurs, in order that comparison with past occurrences of a similar kind may be made. The keeping of such a record-book teaches the children neatness and punctuality; the adding up of the monthly and weekly temperatures and rainfall, trains them in simple arithmetical work; the taking of the observations gives them a feeling of responsibility which makes them accurate and attentive.

Just as the children have, in their earlier, non-instrumental observations, become familiar with the typical weather changes, so they now have their eyes opened to the discovery of other new facts

unknown before. Among these discoveries, which the brighter children will soon make, are the following: The temperature noted during the day, especially during the summer half-year, is prevailingly higher about noon, and in the early afternoon, than in the morning or at night. This, of course, is seen to depend on the sun, and thus the marked control of the sun over our temperature distribution is brought out. In winter this simple diurnal temperature distribution is very often entirely obliterated by the conditions brought about by the passage of storms, which come at irregular intervals, and whose warm and cold winds control our winter temperatures to a great extent. This winter storm control of our weather and temperature, as distinguished from the solar control so characteristic of summer, is one of the marked features of our climate. The relation of certain directions of the wind to certain kinds of weather conditions is soon noted, and in this way a set of simple rules for local weather prediction may be framed. The increase of wind velocity towards noon in summer, with calms in the early morning and at night, cannot fail to be detected by the brighter children.

The diurnal growth of clouds, too, with a maximum cloudiness in the early afternoon and clear sky at night, often noted in summer, must soon appear as a characteristic feature of our spring and summer weather conditions. On clear, calm winter days, temperature readings made in the morning and evening from thermometers at some distance above the ground, as out of a second or third-storey window, or exposed on hills or rising ground, will be found to be higher than the readings made where the thermometers are near the ground, or in valley bottoms. The occurrence of rain and snow at *any* time of day in winter, while in summer our precipitation comes chiefly in the afternoon and evening, from thunderstorms, will soon be noted, both on examining the record, and as a result of individual observation.

These, and very many other facts, may and will be discovered by children who are taught along the lines which have here been indicated. Such work cannot fail to attract both teacher and scholars. It adds to the interest of life; it gives admirable training in simple scientific investigation and habits of thought; it results in making the children more careful, more punctual, and neater in their other work; and it lays a foundation on which, in after years, a more advanced study of meteorology may be built up.

Systematic work on the practical use of the daily weather maps, as outlined in the Report of the Committee of Ten on Secondary School Studies, should follow the simpler elementary exercises suggested in this pamphlet; and it is hoped to indicate, in a later publication, the lines along which this more advanced study should proceed.

ROBERT De C. WARD.

Harvard University, Cambridge, Mass., March 14th, 1896.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1896.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	78·9	29	36·1	4	67·2	45·2	43·4	66	122·9	25·6	·14	3	4·4
Malta	77·5	22	52·3	14	69·7	57·0	55·2	78	129 7	44·8	1·02	7	6·1
Mauritius	79·3	18	62·2	22	77·0	69·1	65·4	79	128·3	53·0	13·55	17	6·4
Calcutta	99·3	23	70·4	8	94·5	77·6	75·2	71	156·0	68·9	4·35	6	4·4
Bombay	93·3	31	79·3	29	91·5	82·1	76·8	73	142·3	72·3	·26	2	2·9
Ceylon, Colombo	92·2	9	70·1	4	89·0	79·1	74·7	78	160·0	63·0	9·31	15	5·9
Melbourne	72·1	1	38·5	8	59·9	47·0	54·0	77	119·9	28 8	2·62	10	6·8
Adelaide	73·7	2	41·5	25	64·5	48·5	46·7	70	130·8	32·1	1·47	14	5·4
Sydney	81·0	3	45·2	13	65·5	52·6	49·8	86	129·7	37·9	3·84	15	4·2
Wellington	65·0	14	38·0	20*b*	59·1	47·1	45·0	74	118·0	24·0	3·03	14	4·3
Auckland	69·0	4	43·0	11	62·5	51·7	48·2	72	106·8	38·0	3·63	18	6·0
Jamaica, Kingston	90·7	15	70·0	1, 3	86·6	72·4	69·9	78	...	...	4·34	9	5·7
Trinidad	94·0	19*a*	69·0	11*c*	91·1	72·0	72·1	76	171·0	67·0	1·62	8	...
Grenada	84·6	3	71·0	16*d*	82·7	74·0	71·6	79	150·2	...	10·16	21	5·1
Toronto	90·8	9	36·5	20	71·1	49·2	48·2	66	105·0	29·0	2·44	10	5·0
New Brunswick, Fredericton	80·2	10	26·0	1	64·7	37·4	37·5	56	...	...	·88	5	4·0
Manitoba, Winnipeg	85·0	6	32·0	2	65·7	44·5	...	...	...	...	5·32	17	7·0
British Columbia, Esquimalt	65·2	29	35·3	15	58·6	43·4	43·6	84	...	...	1·62	18	7·0

a—and 20. *b*—and 21. *c*—and 19. *d*—and 23.

REMARKS.

MALTA.—Adopted mean temp. 62°·1, or 2°·2 below the average. Mean hourly velocity of wind 10·8 miles. Average temp of sea 63°·2. TS on 12th, L on 23rd. Absolute max. and average max. in shade the lowest for May in 13 years. Number of rainy days and the mean amount of cloud the highest recorded for May. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·1 below, of dew point 1°·0 above, and rainfall 9·11 in. above, their respective averages. Mean hourly velocity of wind 11·3 miles or 1·2 mile above the average; extremes, 25·4 on 7th, and 2·1 on 20th; prevailing direction, E.S.E. T and L on 7th, and L on 18th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 7 days. D. G. MANTELL.

Adelaide.—Mean temp. 1°·1 below the average of 39 years. Rainfall 1·42 in. below the average. C. TODD, F.R.S.

Sydney.—Rainfall 1·24 in. below, and humidity 10·8 above, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—Fine up to the 4th, then showery to 7th, heavy R on 8th and 14th, but otherwise generally fine for the remainder of the month, with only light rain at times. Prevailing winds N.W., strong on four days; fog on 14th. Temperature 1°·1 above, and rainfall 1·96 in. below, their respective averages. R. B. GORE.

Auckland.—A showery month, but with no heavy falls of R. Violent N.E. gale on 13th and 14th. Mean temp. almost exactly the average, rainfall slightly below. T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Mean hourly velocity of wind 3·4 miles. Rainfall in Kingston one-fifth less than the average, but the mean for the Island shows a fall of about the average. R. JOHNSTONE.

TRINIDAD.—Rainfall 2·03 in. below the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, OCTOBER, 1896.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall .	4·17	XI.	Lake Vyrnwy	6·09
,,	Birchington, Thor	5·32	,,	Corwen, Rhug	5·59
,,	Hailsham	5·75	,,	Criccith, Talarvor.....	4·98
,,	Ryde, Thornbrough	4·20	,,	I. of Man, Douglas	5·50
,,	Emsworth, Redlands ...	3·19	XII.	Stoneykirk, Ardwell Ho.	2·15
,,	Alton, Ashdell	3·79	,,	New Galloway, Glenlee	3·70
III.	Oxford, Magdalen Col..	2·66	,,	Lilliesleaf, Riddell	4·27
,,	Banbury, Bloxham	...	XIII.	N. Esk Res. [Penicuick]	6·00
,,	Northampton, Sedgebrook	3·70	,,	Edinburgh, Blacket Pl..	4·14
,,	Alconbury	3·26	XIV.	Glasgow, Queen's Park..	3·70
,,	Wisbech, Bank House...	4·02	XV.	Inverary, Newtown	4·96
IV.	Southend	3·19	,,	Oban, The Corran	3·13
,,	Harlow, Sheering..... ...	3·46	,,	Islay, Gruinart Schools..	2·24
,,	Colchester, Lexden	2·64	XVI.	Dollar.....	4·10
,,	Rendlesham Hall	2·83	,,	Balquhidder, Stronvar...	7·18
,,	Rushall Vicarage	2·69	,,	Ballinluig	1·93
,,	Swaffham	4·42	,,	Dalnaspidal H.R.S.....	7·61
V.	Salisbury, Alderbury ...	3·10	XVII.	Keith H.R.S.....	7·00
,,	Bishop's Cannings	2·94	,,	Forres H.R.S.	2·92
,,	Blandford, Whatcombe .	3·55	XVIII.	Fearn, Lower Pitkerrie..	1·90
,,	Ashburton, Holne Vic...	5·48	,,	N. Uist, Loch Maddy ...	4·09
,,	Okehampton, Oaklands.	5·13	,,	Invergarry.....	6·81
,,	Hartland Abbey	4·94	,,	Aviemore H.R.S.	5·12
,,	Lynmouth, Glenthorne.	6·19	,,	Loch Ness, Drumnadrochit	8·42
,,	Probus, Lamellyn	5·17	XIX.	Invershin	2·93
,,	Wellington, The Avenue	3·12	,,	Scourie	6·11
,,	Wincanton, Stowell Rec.	...	,,	Watten H.R.S.....	3·40
VI.	Clifton, Pembroke Road	5·04	XX.	Dunmanway, Coolkelure	4·59
,,	Ross, The Graig	2·85	,,	Cork, Wellesley Terrace	3·12
,,	Wem, Clive Vicarage ...	2·93	,,	Killarney, Woodlawn ...	4·19
,,	Cheadle, The Heath Ho.	3·13	,,	Caher, Duneske	2·45
,,	Worcester, Diglis Lock	1·56	,,	Ballingarry, Hazelfort...	2·82
,,	Coventry, Coundon	2·86	,,	Limerick, Kilcornan ...	2·65
VII.	Ketton Hall [Stamford]	...	,,	Broadford, Hurdlestown	2·48
,,	Grantham, Stainby	3·82	,,	Miltown Malbay	3·67
,,	Horncastle, Bucknall ...	3·69	XXI.	Gorey, Courtown House	3·29
,,	Worksop, Hodsck Priory	3·68	,,	Athlone, Twyford	2·39
VIII.	Neston, Hinderton	4·05	,,	Mullingar, Belvedere ...	2·90
,,	Southport, Hesketh Park	4·92	,,	Longford, Currygrane...	2·59
,,	Broughton-in-Furness ...	6·46	XXII.	Woodlawn	3·37
IX.	Ripon, Mickley.....	4·12	,,	Crossmolina, Enniscoe ..	9·45
,,	Melmerby, Baldersby ...	3·78	,,	Collooney, Markree Obs.	4·90
,,	Scarborough, Obs.	4·58	,,	Ballinamore, Lawderdale	3·69
,,	Middleton, Mickleton ...	3·59	XXIII.	Lough Sheelin, Arley...	2·10
X.	Haltwhistle, Unthank...	4·71	,,	Warrenpoint.....	2·00
,,	Bamburgh	6·18	,,	Seaforde..	2·21
,,	Keswick, The Bank.....	8·29	,,	Belfast, Springfield	3·58
XI.	Llanfrechfa Grange	5·23	,,	Bushmills, Dundarave..	4·47
,,	Llandovery	5·50	,,	Stewartstown	2·67
,,	Castle Malgwyn	6·31	,,	Killybegs	8·57
,,	Builth, Abergwesyn Vic.	8·01	,,	Lough Swilly, Carrablagh	5·76
,,	Rhayader, Nantgwillt ...	6·97			

OCTOBER, 1896.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours Dpth	Greatest Fall in 24 hours Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date.	No. of Nights below 32°. In shade.	No. of Nights below 32°. On grass
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	3·05	+ ·16	·67	12	18	62·9	8, 9	29·2	28	2	14
II.	ENGLAND.	Maidstone (Hunton Court)...	4·51	+ 1·05	·54	13	20	...	...	...	...	..	...
,,	ENGLAND.	Strathfieldsaye	3·25	...	1·09	6	22	...	...	...	...	...	...
III.	ENGLAND.	Hitchin	3·36	+ ·29	·41	15	21	62·0	3	28·0	27	7	...
,,	ENGLAND.	Winslow (Addington)	3·38	+ ·29	·59	25	23	63·0	3	28·0	27	9	14
IV.	ENGLAND.	Bury St. Edmunds (Westley)	3·24	— ·03	·52	12	16	62·0	3	30·0	30	..	...
,,	ENGLAND.	Norwich (Brundall)	3·38	...	·40	12	24	64·4	3	29·0	30	2	12
V.	ENGLAND.	Weymouth(LangtonHerring)	2·47	— 1·07	·80	6	19	63·0	3	32·0	31	1	...
,,	ENGLAND.	Torquay (Cary Green)	3·99	...	·86	6	21	65·6	3	33·6	23*a*	0	10
,,	ENGLAND.	Polapit Tamar [Launceston]..	5·21	+ ·28	·80	5	25	64·9	3	26·1	23	8	10
VI.	ENGLAND.	Stroud (Upfield)	3·72	+ ·69	·75	25	21	65·0	3	29·0	21*b*	6	...
,,	ENGLAND.	ChurchStretton(Woolstaston)	3·84	+ ·07	·60	16	23	63·5	2	30·0	29	8	18
,,	ENGLAND.	Tenbury (Orleton)	2·24	— ·97	·39	16	20	65·0	3	24·7	21	11	17
VII.	ENGLAND.	Leicester (Barkby)	3·08	— ·07	·50	16	25	63·0	3	23·0	30	15	20
,,	ENGLAND.	Boston	3·88	+ ·77	·75	16	20	65·0	16	30·0	23	5	...
,,	ENGLAND.	Hesley Hall [Tickhill].....	3·23	+ ·13	·75	18	24	64·0	2	27·0	27	9	...
VIII.	ENGLAND.	Manchester(PlymouthGrove)	4·34	+ ·97	·85	6	22	66·0	2	26·0	28	11	14
IX.	ENGLAND.	Wetherby (Ribston Hall) ..	2·70	— ·43	·55	6	19	...	...	...	...	...	...
,,	ENGLAND.	Skipton (Arncliffe)	6·08	+ ·05	·86	5	24	..	...	...	...	...	...
,,	ENGLAND.	Hull (Pearson Park).	6·01	+ 2·36	1·02	18	26	62·0	8	27·0	27	14	15
X.	ENGLAND.	Newcastle (Town Moor)	5·68	+ 2·56	1·03	10	25	...	...	...	...	...	...
,,	ENGLAND.	Borrowdale (Seathwaite).....	13·02	+ 2·43	2·65	7	22	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	4·77	+ ·23	·83	24	19	...	...	...	...	...	...
,,	WALES.	Haverfordwest	6·89	+ 1·74	1·15	9	23	62·1	3	27·9	29	5	15
,,	WALES.	Aberystwith (Gogerddan)	4·79	— ·56	·60	6	20	62·0	2	...	...	...	...
,,	WALES.	Llandudno.....	4·20	+ ·81	·81	7	21	64·5	2	32·5	29	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	4·19	+ ·93	1·76	7	12	60·8	2	23·0	28	12	...
,,	SCOTLAND.	Jedburgh (Sunnyside).....	5·85	+ 3·20	1·76	11	17	61·0	2	25·0	23	7	...
XIV.	SCOTLAND.	Colmonell	3·51	...	·90	7	15	67·0	2	21·0	22	11	...
XV.	SCOTLAND.	Lochgilphead (Kilmory)	4·80	+ ·01	·84	23	17	...	...	23·0	22	18	...
,,	SCOTLAND.	Mull (Quinish).....	4·58	— ·71	1·19	8	17	...	...	...	...	...	...
XVI.	SCOTLAND.	Loch Leven Sluices	3·90	+ ·94	1·00	8	11	...	...	...	...	...	...
,,	SCOTLAND.	Dundee (Eastern Necropolis)	2·90	+ ·66	·90	7	17	63·3	2	25·5	25	9	...
XVII.	SCOTLAND.	Braemar	5·68	+ 2·07	1·26	18	21	62·7	1	17·0	25	16	25
,,	SCOTLAND.	Aberdeen (Cranford)	4·53	...	1·10	18	23	65·0	1, 2	26·0	24*c*	9	..
,,	SCOTLAND.	Cawdor (Budgate)	5·01	+ 2·28	1·00	9	19	...	...	...	...	...	...
XVIII	SCOTLAND.	Strathconan [Beauly]	7·01	+ 2·36	1·08	19	14	...	...	...	...	..	...
,,	SCOTLAND.	Glencarron Lodge.....	7·32	...	1·42	9	24	55·7	1	23·0	25	14	...
XIX.	SCOTLAND.	Dunrobin	3·07	— ·24	·50	7	21	61·0	1	30·0	10*c*	5	...
,,	SCOTLAND.	S. Ronaldsay (Roeberry).....	5·25	+ 1·52	1·01	5	23	56·0	1	30·0	10	3	...
XX.	IRELAND.	Darrynane Abbey.....	5·72	...	·79	1	23	...	...	...	...	...	...
,,	IRELAND.	Waterford (Brook Lodge) ...	2·79	— 1·03	1·12	7	16	68·0	1	27·0	28	6	...
,,	IRELAND.	O'Briensbridge (Ross)	3·19	...	·44	24	19	..	...	...	...	...	...
XXI.	IRELAND.	Carlow (Browne's Hill)	3·90	+ ·61	1·17	7	18	...	..	...	...	...	...
,,	IRELAND.	Dublin (FitzWilliam Square)	2·51	— ·87	·77	7	22	63·7	2	30·1	23	2	13
XXII.	IRELAND.	Ballinasloe	...	...	...	...	...	...	...	...	...	...	...
,,	IRELAND.	Clifden (Kylemore)	8·63	...	1·40	7	26	...	...	...	...	.	...
XXIII	IRELAND.	Waringstown	2·76	+ ·05	·49	7	21	60·0	1	26·0	13*d*	11	18
,,	IRELAND.	Londonderry (Creggan Res.).	4·96	+ 1·29	·87	7	30	...	...	...	...	...	...
,,	IRELAND.	Omagh (Edenfel)	4·36	+ 1·26	·57	7	25	59·0	1	27·0	27	5	15

+Shows that the fall was above the average ; —that it was below it.

a—and 29. *b*—and 27. *c*—and 25. *d*—and 28.

METEOROLOGICAL NOTES ON OCTOBER, 1896.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

ADDINGTON.—A wet month, with very few really fine days, and a large flood on the 16th and 17th. Dense fog on 28th and 29th. Frequent slight frosts from the 20th to the end; many tender plants cut off on the 23rd, and all killed on the 28th. Autumn tints very beautiful.

BURY ST. EDMUNDS, WESTLEY.—R nearly every day till the 21st. Very little frost, but a cold month, the temp. reaching 62° on only one day. TSS on 5th, 10th and 14th; T on 25th.

NORWICH, BRUNDALL.—Much depressing, damp weather, with frequent rains, though at no time excessively heavy. The frequency of the rain made it appear wetter than many months which have had a much larger total fall. Severe TS on the morning of the 14th, quite overhead at 7 a.m. Stormy with H and L on 5th; S.W. gale on 8th; stormy with T and L on 25th.

WEYMOUTH, LANGTON HERRING.—The first ten days of the month were mild, with a good deal of wet; the weather became much colder on the 11th, on which day the temp. was 10° lower than on the 10th; and with the exception of the 15th and 16th, it continued cold to the end. On 16 days the min. temp. was below 40°, and on 14 days the max. was below 50°. The mean 9 a.m. temp.—46°·5—is 3°·5 below the average. Solar halo on 1st; T and L on 18th.

TORQUAY, CARY GREEN.—Rainfall ·33 in. below the average, the fall for the 10 months January to October being 8·75 in. below the average. Mean. temp. 47°·8, or 3°·5 below average. Duration of sunshine, 120 hours, being 4 hours above the average; 5 sunless days.

POLAPIT TAMAR [LAUNCESTON].—Very wet throughout, but the total fall for the first ten months of the year is 4·14 in. less than the average. The first ten days were generally rough and stormy, and the last fortnight, though calm, was very cold. H on 4th, 5th, 18th, 25th and 27th; S.W. gales on 6th, 7th, 8th and 25th. S on 11th.

STROUD, UPFIELD.—Severe S.W. gales on 6th and 7th. S storm on 25th.

WOOLSTASTON.—A cold, wet month. Mean temp. 43°·5. S on 10th and 24th.

LEICESTER, BARKBY.—A cold, wet month, with considerable fog and some sleet and flakes of S. Last swallow seen on 18th. Mean temp. 44°·1.

MANCHESTER, PLYMOUTH GROVE.—The coldest October since observations commenced in 1868. H storm, T and L on 10th. S and sleet on 11th. Thick fog on 19th, 20th, 22nd and 31st. Dense fog on 27th. Mean temp. 43°·5.

NEWCASTLE.—The heaviest month's R at this station since August, 1890, when the total fall was 6·22 in.

SEATHWAITE.—S on 11th, 1½ in. deep at 9 a.m., on 22nd 1 in. deep, and on the 25th 2 in. deep. Six falls of R of exceeding an inch in 24 hours.

WALES.

HAVERFORDWEST.—The most stormy October since 1886, and unprecedented damage was done on this coast. On the 8th a great tempest arose from S.S.E. with heavy R, and this, together with a very high spring tide, caused the

waters to rise to such a height that houses were flooded, and on the exposed beach at Newgate the ocean broke in, overwhelming the lofty pebble barrier and sweeping away a lonely house on the shore. A heavy fall of S on 11th, and S on the mountains on 26th. L and T on 7th, 25th and 29th; L on 9th, 11th and 18th.

ABERYSTWITH, GOGERDDAN.—Very stormy and cold throughout the month. S on the 25th.

SCOTLAND.

CARGEN [DUMFRIES].—Another dreary, sunless month. The mean temp.—43°·4—is nearly 4° below the average of 37 years, and was lower only in 1892—43°·1. A deep depression crossed on the 8th, accompanied by a severe S.W. gale; one of the highest spring tides of the year occurred concurrently, and an exceptionally heavy rainfall having taken place during the previous night, the Nith was in heavy flood, overflowed its embankments, and a large tract of arable land was submerged, and much damage done. 1·76 in. of R fell on the 7th, and on only six occasions has more fallen in 24 hours since observations commenced. The total R for the 10 months of the year is 2·63 in. below the average. With the exception of the gale on 8th, and stiff breezes on 5th and 11th, light winds, generally E., prevailed. Sunshine again much deficient. S covered the district on the 25th.

JEDBURGH.—The weather was most ungenial during the month, N. and N.E. winds prevailing, with very little sunshine and low temperature, excepting about six days. Country work has gone on well. The rainfall of the month has never been so heavy during 32 years.

BRAEMAR.—A very unsettled, cold month.

ABERDEEN, CRANFORD.—The month has been cold and wet, with little sunshine and N. or N.E. wind after the 10th.

S. RONALDSAY, ROEBERRY.—A very cold, wet and windy month. N. or N.E. wind on 16 days. Mean temp. 42°·6, being 3°·9 below the average of six years.

IRELAND.

DARRYNANE ABBEY.—A cold, wild month. The very high tide and strong gale on the night of the 7th-8th broke over the embankment, and flooded the rain gauge. [Amount originally estimated has been confirmed by comparison with two other records.—ED.].

WATERFORD, BROOK LODGE.—H on 4th. Heavy gale from S.W. to S.E. on 8th. S from 7 to 11 a.m. on 11th. L on 12th and 27th. Lunar halo on 20th.

DUBLIN.—As in 1892 and 1895, so in 1896 October proved a very cold month. It was also inclement in the matter of wind and R. Had it not been for a few warm days at the beginning, the mean temp. would have been the lowest on record in recent years. Mean temp. 45°·0, or 4°·7 below the average. TSS on the evening of the 29th; L on night of 21st. High winds on 11 days, attaining the force of a gale on the 8th. Foggy on 4 days; H on 3 days; sleet on 3 days. A lunar halo on the 18th; solar halos on 7th, 10th and 23rd; aurora borealis on the evening of the 11th.

WARINGSTOWN.—Nights unusually cold. S on 28th.

OMAGH, EDENFEL.—The weather of October has been of the same stormy, wet and unsettled character that has prevailed since the 17th August, between which date and the 13th October but five days occurred without rain, mostly heavy; but this cessation was of short duration, as from the 17th to the end was equally unpropitious, and the damage to all crops has been irreparable.